AN APPARATUS AND METHOD FOR DETERMINING A LEVEL OF CONFIDENCE IN A RISK ASSESSMENT AND/OR DETERMINING A LEVEL OF ACCEPTABILITY OF AN EVENT OCCURING

FIELD OF THE INVENTION

The present invention relates to an apparatus and method for assisting a user in determining a level of confidence in a risk assessment and/or assisting the user in determining a level of acceptability of an event occurring.

BACKGROUND OF THE INVENTION

Risk is something which we all encounter in our everyday lives. For example, we risk being involved in an accident whenever we travel in a motor vehicle. Generally speaking, risk can be defined as the likelihood of some event occurring by the impact or consequences of that event; that is, risk = likelihood * impact.

A great deal of research has been undertaken in order to develop techniques for determining risk. Some of the more common techniques include: statistical analysis; forward simulations; mathematical modelling; and judgement or guessing. The problem with existing techniques for determining risk is that they do not take into account the validity of the information or process used to derive the risk. For example, where risk is determined using statistical analysis (of sampled data) the validity of the risk calculation (that is, the level of confidence a person can have in the risk calculation) will depend to some degree on the number of data samples used in the statistical analysis. Where only a few samples are taken the validity of the risk would be lower than if the risk were derived using a large number of samples.

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        Unfortunately, existing methods do not provide any
indication as to the validity of a risk calculation.
Consequently, a person using the risk calculation is
unable to determine just how much confidence he/she can
5   have in the calculated risk. This can be detrimental if,
for example, a person has too much confidence in a risk
calculation which is based on statistical analysis using
only a few data samples (a low validity).

10   Existing techniques for determining risk assessment
also do not give any indication as to the level of
acceptability of the event occurring.

SUMMARY OF THE INVENTION

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        According to a first aspect of the present invention
there is provided an apparatus for assisting a user in
determining a level of confidence in a risk assessment,
the apparatus comprising:
20   input means for receiving at least one of a set of
factors each of which can affect the level of confidence
in the risk assessment;
        storage means for storing the set of factors and a
set of weighting indicators, wherein each factor within
25   the set of factors is associated with a weighting
indicator from the set of weighting indicators;
        processing means for processing the at least one of
the set of factors entered into the input means and
processing the set of factors stored in the storage means
30   in order to identify a factor in the set of factors which
corresponds to the at least one factor entered into the
input means; and
        output means for outputting the set of weighting
indicators and the weighting indicator associated with the
35   factor identified by the processing means.

        Thus, the information output by the output means can

assist the user in determining the level of acceptance in the risk assessment. The set of weighting factors provide a context against which the weighting indicator associated with the factor identified by the processing means can be
5   assessed.

Preferably, the set of factors comprises: information about a technique used to obtain the risk assessment; the extent to which the technique is used to obtain the risk
10   assessment; a level of acceptance of the technique and extent to which the technique is used to obtain the risk assessment; and information about the environment of the risk assessment.

15   Preferably, the set of weighting indicators and the set of factors are arranged as a matrix, wherein the set of weighting indicators are entries in the matrix and the set of factors provide an index to the entries.

20   Thus, by acting as an index to the entries, each of the set of factors is associated with a weighting indicator.

Preferably, each of the set of factors providing the
25   index to the entries in the matrix are divided into sub-factors.

Preferably, the set of factors providing the index to the entries in the matrix comprises: the information about
30   the environment of the risk assessment; information about techniques used to perform the risk assessment; an extent to which the technique is used to obtain the risk assessment; and a level of acceptance of the technique the extent to which the technique is used to obtain the risk
35   assessment.

Preferably, the sub-factors for the environment of

the risk assessment comprises: simple; low; moderate; high moderate; and complex.

Preferably, the sub-factors for the extent to which
5   the technique is used comprises: basic; moderate; and extensive.

Preferably, the input means allows the user to enter and/or change the set of factors and the set of weighting
10 indicators.

Preferably, the input means is capable of storing in the storage means the set of factors and the set of weighting indicators entered into the input means.
15
Preferably, the input means comprises a graphical user interface.

Preferably, the storage means comprises a computer
20 storage medium.

Preferably, the computer storage medium comprises a database.

25   Preferably, the processing means comprises a suitably configured computer.

Preferably, the output means comprises a graphical user interface.
30
Alternatively, other forms of computer presentation devices can be used as the output means. For example, the output means could be a printer.

35   According to a second aspect of the present invention there is provided a method for assisting a user in determining a level of confidence in a risk assessment,

the method comprises the steps of:

      entering into an input means at least one of a set of
factors each of which can affect the level of confidence
in the risk assessment;

5   storing in a storage medium the set of factors and a
set of weighting indicators, wherein each factor within
the set of factors is associated with a weighting
indicator from the set of weighting indicators;

      processing the at least one of the set of factors

10   entered into the input means and processing the set of
factors stored in the storage means in order to identify a
factor in the set of factors which corresponds to the at
least one factor entered into the input means; and

      outputting the set of weighting indicators and the

15   weighting indicator associated with the factor identified
by the processing step.

      Thus, the information output by the output means can
assist the user in determining the level of acceptance in

20   the risk assessment. The set of weighting factors provides
a context against which the weighting indicator associated
with the factor identified by the processing means can be
assessed.

25   Preferably, the method further comprises the step of
arranging the set of factors as a matrix, wherein the set
of weighting indicators are entries in the matrix and the
set of factors provide an index to the entries.

30   Thus, by acting as an index to the entries, each of
the set of factors is associated with a weighting
indicator.

      Preferably, the method further comprises the step of

35   entering and/or changing the set of factors and the set of
weighting indicators entered into the input means.

According to a third aspect of the present invention, there is provided an apparatus for assisting a user in determining a level of acceptability of an event occurring, the apparatus including:

5   input means for receiving a likelihood value which represents a likelihood that the event will occur, and a confidence value which represents a level of confidence that the user has in the likelihood value;

storage means for storing a plurality of records each
10   of which includes an indicator representing a level of acceptability of the event occurring, a range of likelihood values, and a range of confidence values;

identify means for identifying one of the records in the storage means, the one of the records being identified
15   by processing the likelihood value and the confidence value received by the input means, and each of the records stored in the storage means; and

output means for outputting the indicator of the one of the records identified by the identifying means.
20

Thus, by outputting the indicator the user can determine the level of acceptability of the risk assessment.

25   Preferably, the range of confidence values of the record identified by the identify means comprises the confidence value received by the input means, and the range of likelihood values of the record identified by the identify means either comprises the likelihood value
30   received by the input means or is numerically closer to the likelihood value received by the input means than the range of likelihood values of any other of the records for which the range of confidence values comprise the confidence value received by the input means.
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Preferably, the indicator in each of the records is a visual indicator each being a different colour or symbol.

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Preferably, the range of likelihood values in each of the records comprises a range of probability values.

5   Preferably, the range of confidence values in each of the records comprises a range of integers.

Preferably, the input means is configured to allow the user to enter and/or change the range of likelihood 10   values and/or range of confidence values in each of the records.

Preferably, the input means comprises a graphical user interface.
15

Preferably, the storage means comprises a computer storage medium.

Preferably, the computer storage medium comprises a 20   database.

Preferably, the identify means comprises a suitably configured computer.

25   Preferably, the output means comprises a graphical user interface.

Alternatively, other forms of computer presentation devices can be used as the output means. For example, the 30   output means could be a printer.

According to a fourth aspect of the present invention, there is provided a method for assisting a user in determining a level of acceptability of an event 35   occurring, the method comprising the steps of:
receiving a likelihood value which represents a likelihood that the event will occur, and a confidence

value which represents a level of confidence that the user
has in the likelihood value;

storing a plurality of records each of which includes
an indicator representing a level of acceptability of the
5 event occurring, a range of likelihood values, and a range
of confidence values;

identifying one of the records stored by the storing
step, the one of the records being identified by
processing the likelihood value and the confidence value
10 received by the receiving step, and each of the records
stored by the storing step; and

outputting the indicator of the one of the records
identified by the identifying step.

15   Thus, by outputting the indicator the user can
determine the level of acceptability of the risk
assessment.

Preferably, the range of confidence values of the
20 record identified by the identifying step comprises the
confidence value received by the receiving step, and the
range of likelihood values of the record identified by the
identifying step either comprises the likelihood value
received by the input means or is numerically closer to
25 the likelihood value received by the receiving step than
the range of likelihood values of any other of the records
for which the range of confidence values comprises the
confidence value received by the input means.

30   Preferably, the method further comprises the step of
entering and/or changing the range of likelihood values
and/or range of confidence values in each of the records.

According to a fifth aspect of the present invention,
35 there is provided an apparatus for determining a level of
confidence in a risk assessment, the apparatus comprising:

obtaining means operable to obtain a weighting that
is associated with at least one of a plurality of factors
that can influence a reliability of the risk assessment;
and

5   comparing means operable to compare the weighting to
a range of weightings which are associated with the
factors in order to determine the level of confidence in
the risk assessment.

10   Preferably, the obtaining means is such that it uses
the at least one of the factors to retrieve the weighting
from a record of the weightings.

Preferably, the obtaining means is operable to
15   retrieve the weighting from the record by using a first
index and a second index to retrieve the weighting from
the record, wherein the first index corresponds to a first
of the at least one of the factors, and the second index
corresponds to a second and a third of the at least one of
20   the factors.

Preferably, the first of the at least one of the
factors relates to an environmental parameter associated
with the risk assessment, the second of the at least one
25   of the factors relates to an extent of work performed to
determine the risk assessment, and the third of the at
least one of the factors relates to a level of acceptance
associated with the amount of work performed and a
technique used to perform the work.
30
Preferably, the record comprises a matrix that
contains an entry for each of the weightings, and the
first index and the second index correspond to an x, y
coordinate for the entry.
35
According to a sixth aspect of the present invention,
there is provided a method of determining a level of

confidence in a risk assessment, the method comprising the
steps of:

    obtaining a weighting that is associated with at
least one of a plurality of factors that can influence a
5 reliability of the risk assessment; and

    comparing the weighting to a range of weightings
which are associated with the factors in order to
determine the level of confidence in the risk assessment.

10   Preferably, the step of obtaining the weighting
comprises using the at least one of the factors to
retrieve the weighting from a record of the weightings.

    Preferably, the step of using the at least one of the
15 factors to retrieve the weighting comprises the step of
using a first index and a second index to retrieve the
weighting from the record, wherein the first index
corresponds to a first of the at least one of the factors,
and the second index corresponds to a second and a third
20 of the at least one of the factors.

    Preferably, the first of the at least one of the
factors relates to an environmental parameter associated
with the risk assessment, the second of the at least one
25 of the factors relates to an extent of work performed to
determine the risk assessment, and the third of the at
least one of the factors relates to a level of acceptance
associated with the amount of work performed and a
technique used to perform the work.
30

    Preferably, the record comprises a matrix that
contains an entry for each of the weightings, and the
first index and the second index correspond to an x, y
coordinate for the entry.
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BRIEF DESCRIPTION OF THE DRAWINGS

Notwithstanding any other embodiments which may fall
within the scope of the present invention, an embodiment
5   of the present invention will now be described, by way of
example only, with reference to the accompanying figures,
in which:

Figure 1 illustrates an apparatus for assisting a
10 user in determining a level of confidence in a risk
assessment according to the embodiment of the present
invention;

Figure 2 illustrates an apparatus for assisting a
15 user in determining the acceptability of an event
occurring according to the embodiment of the present
invention;

Figure 3 illustrates a matrix stored in the storage
20 means shown in figure 1;

Figure 4 shows a table mapping sub-factors forming
the environment factor stored in the storage means
illustrated in figure 1;
25
Figure 5 shows a matrix used to derive the indexes
shown in the table of figure 4; and

Figure 6 shows information stored in the storage
30 means illustrated in figure 2; and

Figure 7 shows information related to factors that
can be entered into the system of figure 1; and

35   Figures 8 to 11 shows several images of the graphical
user interface displayed by the system of figure 1.

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AN EMBODIMENT OF THE INVENTION

As can be seen in figure 1, the embodiment of the apparatus 1 for assisting a user in determining a level of
5   confidence in a risk assessment comprises: an input means 3; storage means 5; processing means 7; and output means 9.

The apparatus 1 is in the form of a computer. The
10 input means 3 is in the form of software which when run on the apparatus 1 effects display of a graphical user interface (GUI) on a visual display of the apparatus 1. The graphical user interface of the input means 3 is arranged to allow the user to enter a set of factors, each
15 of which can effect a level of reliability in the risk assessment.

The set of factors entered into the input means 3 comprises: information about the environment of the risk
20 assessment; information about the technique used to obtain the risk assessment; information about an extent to which the technique is used to obtain the risk assessment; and information about a level of acceptance of the technique and the extent to which the technique is used.
25
The information about the technique describes the technique employed to arrive at the risk assessment. For example, it describes the fact that the risk assessment was derived from either a personal assessment or by using
30 a more formal technique such as statistical analysis to obtain the risk assessment. With regard to the extent to which the technique is used to obtain the risk assessment, this describes, for example, the number of samples on which the technique of statistical analysis was applied.
35 The level of acceptance describes the number of people who accept the technique applied to the extent it is claimed to be applied. Finally, the information about the

environment describes the environment in which risk
assessment is applicable. For instance, where the
environment can be readily controlled (for example, a
manufacturing environment) the environment is described as
5 being relatively simple. In contrast, where the
environment relates to the share market, in which there
are many variables that can not be controlled or easily
predicted, the environment is described as being highly
complex.
10

Thus, the input means 3 (which as mentioned
previously, displays a graphical user interface) allows
the user to enter, for example, the fact that the risk
assessment was calculated using statistical analysis and
15 that the environment is highly complex

The storage means 5 is in the form of a computer
storage medium, and in particular is a database such as
that available from Oracle. The storage means 5 stores a
20 record containing a plurality of factors that can
influence the reliability of the risk assessment. The
storage means 5 also stores a plurality of weightings that
are associated with the factors stored in the storage
means 5. Essentially, each of the plurality of weightings
25 represents a level of confidence in the risk assessment in
relation to particular weightings.

More specifically, the factors and weightings are
arranged as a matrix 10 (see figure 3). The weightings in
30 the record are entries in the matrix 10, whilst the
factors in the record act as an index 11 and 13 to the
entries in the matrix 10.

Each of the indexes 11 represent an environment in
35 which the risk assessment was made, and is divided into a
number of different levels. The symbols 1e – 4e of the
matrix 10 in figure 3 are a convenient means for

representing each of the different levels of the
environment. The mapping of the symbols to the different
levels of the environment is shown in figure 4. The
indexes 13 of the matrix 10 in figure 3 are derived from
5   another matrix 14 which is shown in figure 5. The matrix
14 also has indexes 15 and 17, and entries which are the
symbols (1b - 12b) used as the indexes 13 in the matrix 10
of figure 3. The indexes 15 represent the extent of work
performed by the technique to derive the risk assessment.
10   As can be seen in figure 5, the extent of the work
performed is divided into a number of different levels,
which include: basic, moderate, and extensive. As an
example, if statistical analysis is used to derive the
risk assessment and only a small number of samples are
15   used, then the level of work performed is considered
"basic". However, if a large number of samples were used
then the level of work performed would be considered as
"extensive".

20   The indexes 17 represent a level of acceptance of the
technique and extent to which the technique is used to
calculate the risk assessment. As can be seen in figure 5,
the indexes 17 are divided into a number of different
levels, which comprise: single view; small group
25   validation; large group validation; and widely accepted.
Thus, by using the matrix 14 illustrated in figure 5 one
can readily determine what the symbols 13 in figure 3
represent. For example, the symbol 6b in the matrix 10 of
figure 3 represents that extensive work was performed in
30   obtaining the risk assessment, and that the technique
employed to obtain the risk assessment is considered
acceptable by a small group of people.

         The user of the apparatus 1 is required to enter into
35   the input means 3 the following factors: the environment;
the level of acceptance of the technique and extent to
which the technique is used to obtain the risk assessment,

and the extent of work performed by the technique. More
specifically, the user would enter the level of the
factors applicable to the risk assessment. For example, if
the environment was complex, the user would enter
5   "complex" into the input means 3. A summary of the various
levels of the factors entered into the input mean 3 is
provided in figure 7.

        Once the level of the factors have been entered into
10   the input means 3, the processing means 7 proceeds to
process the factors entered into the input means 3 and the
matrix 10 in order to identify the indexes 11 and 13 which
match the factors entered into the input means 3. For
example, if the factors entered into the input means 3
15   where a "high-moderate" environment with "extensive" use
of a technique which is accepted by a "large group", then
the processing means 7 would identify the symbols "3e" and
"9b". The symbol "3e" being derived from the table shown
in figure 4, whilst the symbol "9b" is obtained from the
20   matrix 14 shown in figure 5. Once the processing means 7
has determined the appropriate symbols, it proceeds to
identify the equivalent indexes 11 and 13 in the matrix 10
of figure 3.

25   It is noted that the processing means 7 is in the
form of software that is executed by the apparatus 1.

        Once the processing means 7 has identified the
appropriate indexes 11 and 13, the output means 9 proceeds
30   to retrieve the weighting which is located at the
intersection of the index 11 and 13 which have been
identified by the processing means 7. In the case of the
example given in the above paragraph, the intersection of
3e and 9b is a weighting of "7". The retrieved weighting
35   factor along with the range of weighting factors in the
matrix 10 (that is, 2 - 10) is then output by the output
means 9. By outputting the weighting "7" and the range "2

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- 10" the user is able to put the weighting into context.
In the case of the given example, one can see that "7"
rates relatively highly of the range of "2 - 10". Thus,
assuming 10 represents a high level of confidence in the
5   risk assessment and 2 represents a low level of confidence
in the risk assessment, one can safely say that the
weighting of "7" rates relatively highly on the range of
"2 - 10". Consequently, a risk assessment of "7" means
that the user can have a reasonable level of confidence in
10 the risk assessment.

It is noted the output means 9 is in the form of
software that runs on the apparatus 1, and which effects
display of a graphical user interface on the visual
15 display of the apparatus 1.

In the present embodiment, the matrix 14 and the
table illustrated in figure 4 are defined by a user of the
apparatus 1. The input means 3 allows the user to define
20 the matrix 14 and the table via the graphical user
interface. Similarly, the entries in the matrix 10 are
defined by the user via the graphical user interface of
the input means 3.

25   In addition to assisting a user to determine a level
of confidence in the risk assessment, the apparatus 1 also
enables the user to determine a level of acceptability of
an event occurring. In this regard, the apparatus 1 also
comprises an identifying means 19. The input means 13 is
30 such that it enables the user to enter a likelihood value
which represents a likelihood that the event will occur,
and a confidence value which represents a level of
confidence that the user has in the likelihood value.

35   The likelihood and confidence values entered into the
input means 3 are in the form of a probability value (for
example, 0.2 %) and integer value (for example 3),

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respectively.

The storage means 5 is such that it stores a
plurality of records, each of which comprises an indicator
5   representing a level of acceptability of the event
occurring. The record also comprises a range of likelihood
values and a range of the confidence values.

The indicators in the storage means 5 are visual
10   indicators, each of which is a different colour or symbol.
Where, for example, the indicator represents a very low
level of acceptability, the relative indicator is the
colour red, whilst a high level of acceptability is
represented by the colour green. Where an indicator
15   represents a medium level of acceptability, the indicator
is orange in colour.

The range of likelihood values in each record is
essentially a different range of likelihood values. For
20   example, a first record can have the range of < 0.5%, a
second record can have the range 0.5% - 1.05% and a third
record can have the record > 1.05%. The range of
confidence values are ranges of confidence values (which
are integers), such as 8 - 10, 5 - 10 and 1 - 10.
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Figure 6 provides a conceptual diagram of the records
that are stored in the storage means 5. With reference to
figure 6, the indicators are marked 21, the ranges of
likelihood values are marked as 23 and the ranges of
30   confidence values are marked as 25. Once the likelihood
value and confidence value have been received by the input
means 3, the identify means 19 proceeds to process the
received likelihood and confidence values and the ranges
of likelihood values and the ranges of confidence values
35   in each of the records in order to identify one of the
records. The identifying means 19 is in the form of
software that runs on the apparatus 1.

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The range of confidence values of the record
identified by the identifying means 19 comprises the
confidence value received by the input means 3, and the
5   range of likelihood values of the record identified by the
identifying means 19 either comprises the likelihood value
received by the input means 3 or is numerically closer to
the likelihood value received by the input means 3 than
the range of likelihood values of any other of the
10   records.

For example, where the input means 3 receives a
likelihood value of 0.55% and a confidence value of 4, the
identifying means 19 identifies the bottom record (of
15   figure 6); that is, the record having a likelihood range
of > 1.05% and a confidence range of 1 - 10.

After the identifying means 19 has identified a
record, the output means 9, which is in the form of
20   software that effects a display of a graphical user
interface on the monitor of the apparatus 1, retrieves the
indicator from the identified record and displays it to
the user via the graphical user interface. Thereby
assisting the user is assessing the acceptability of the
25   risk assessment.

The input means 3 is also configured to allow the
user to enter and/or change the range of values and/or
range of confidence values in the records. This is
30   provided for via the graphical user interface of the
output means. The input means 3 also allow the number of
indicators to be changed.

With regard to figures 8 to 11, these figures
35   represent the graphical user interfaces that enables the
user to enter information (e.g. factors) into the system
1, and display information to the user, (e.g. weightings).

Those skilled in the art will appreciate that the invention described herein is susceptible to variations and modifications other than those specifically described.

5 It should be understood that the invention includes all such variations and modifications which fall within the spirit and scope of the invention.